

TORSION MANAGEMENT OUTSOLES AND
SHOES INCLUDING SUCH OUTSOLES

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CROSS REFERENCE TO RELATED APPLICATION

This application is a continuation-in-part of co-pending U.S. Application No.
10 10/047.320, filed January 14, 2002, which is incorporated herein in its entirety by
reference.

TECHNICAL FIELD

15 The present invention is directed to an outsole. More particularly, the
present invention is directed to a golf shoe having an improved outsole that
enables greater torsional movement and flexibility of the shoe.

BACKGROUND OF THE INVENTION

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Historically, people first wore shoes to protect their feet. Over the centuries,
footwear evolved into many different types that were specific to particular activities.
Thus, the protection offered by a cold-weather work boot is highly different from
that offered by a running shoe. In addition to protecting the feet, athletic footwear
25 has further developed to offer specific functions dependent on the particular sport.
Soccer shoes, for instance, have spikes for traction, whereas cycling shoes have
very stiff soles with mounting plates for cleats to engage the pedal. In this manner,
golf shoes have evolved to provide the wearer with good traction on grass, comfort
while walking, and a stable platform for hitting the ball. Typical golf shoes thus
30 have a relatively stiff sole with metal spikes or plastic cleats.

A stiff sole, while providing a stable platform, can nonetheless cause
discomfort because there is a balance between how the foot should be allowed to
move versus how it should be supported. An example of this is the fact that during
walking and at the start and finish of the golf swing, the foot bends at the
35 metatarsal joints (the ball). Aside from the physical effort needed to flex a very stiff
sole (which would tend to cause a 'clunky' gait as when wearing clogs), sole
stiffness tends to cause the heel of the foot to slide up and down in the heel cup,
potentially causing blisters. Thus, golf shoes have evolved to have soles that flex

across the ball area to allow this movement without compromising the lateral
5 stability of a good hitting platform.

Relatively recent studies in biomechanics have sought to better quantify how
the 26 bones of the foot move relative to each other during human movements.
One particular motion that has been identified is a torsional movement about the
long axis of the foot. In effect, the forefoot and rearfoot twist relative to each other.
10 It is thought that this movement smoothes the contact between foot and ground,
decreasing impacts with the ground as well as providing better ground contact.
This observation has led to the development of a golf shoe sole to allow this
natural movement.

U.S. Patent No. Re. 33,194, reissued from U.S. Patent No. 4,608,970, to
15 Marck et al. discloses an orthopedic device for correcting infants' feet. The device
includes a posterior part, an anterior part, and a ball-and-socket for allowing three
degrees of freedom between the posterior and anterior parts during set-up. These
parts are immobilized in a particular position, when the device is in use. As a
result, this device does not assist with the natural torsional-like action of the foot in
20 walking where such action is missing.

U.S. Patent No. 3,550,597 discloses a device that facilitates the natural
rolling action of the foot during movement by providing a flat construction with front
and rear main lifting sections rigidly connected to a resilient intermediate section
that is twisted into the form of a flat torsion spring. The device applies a yieldable
25 torsional action during use that is applied to the foot by the lifting sections, whereby
the heel of the foot is urged upwardly at the inner side and the forefoot is raised
upwardly at the outer side, producing a torsional action similar to the natural torsion
action of the foot.

Another construction intended to provide greater support to the wearer of
30 the shoe is disclosed in U.S. Patent No. 5,243,776 to Zelinko. The Zelinko golf
shoe has a sole having a forward end, a heel end and an intermediate portion
joining the two ends. A spike support plate is journaled to a post extending from
the forward end of the shoe. The spike support plate is so mounted to the forward
end for rotation about a vertical axis. A biasing means, such as tension springs, is
35 provided to connect the spike support plate to the heel end and for constantly
biasing the spike support plate to a neutral (*i.e.*, non-rotated) position and returning
the support to that position after the support has been rotated. A cover is provided
to protect the biasing means. The Zelinko golf shoe is constructed to allow the

forward end of a golfer's foot to remain fixed during a golf swing while the heel
5 rotates.

There remains a need for an improved outsole for a shoe that enables an individual movement of the foot, particularly, the rotation between the rearfoot and the forefoot. By allowing and controlling these rotations, the outsole would resist torsional instability during play, provides independent traction suspension, and
10 increases the flexibility of the shoe to accommodate the movement of the wearer.

SUMMARY OF THE INVENTION

The present invention is directed toward an outsole for a shoe construction
15 having a forward portion, and a rearward portion, coupled together by torsion means at a pivot. The torsion means for coupling includes a pair of angled stabilizer rods. The forward and rearward portions are operatively connected to freely allow independent and relatively reciprocal movement of the forward and rearward portions about the pivot. This movement may occur during a user
20 walking with the outsole or swinging a golf club.

In one embodiment, the forward and rearward portions may be operatively connected discrete pieces. In another embodiment, the outsole may include a rotational connection configured to allow relative movement of the forward and rearward portions.

25 In yet another embodiment, the present invention is directed to a shoe comprising an outsole and an upper generally configured to accommodate a foot connected to the outsole. The outsole includes a forward portion for supporting the forefoot of a foot and a rearward portion for supporting the heel of the foot. The forward portion defines a chamber. The rearward portion includes a
30 protrusion. The forward and rearward portions are operatively connected when the protrusion is received in the chamber.

In another embodiment, the present invention includes an outsole comprising a first piece, a second piece, and a third piece, each piece separate from each other. A flexible member joins the first piece to the second piece, and
35 another flexible piece joins the second piece to the third piece. The flexible members include a length that is less than the length of each of the adjoining pieces. Furthermore, the material of the flexible member is substantially softer than the first and second piece materials.

5 In an embodiment of the invention, the outsole comprises the first and second piece materials having a Shore A greater than about 75 and the flexible member material having a Shore A less than about 85. In addition, in such an outsole the first and second piece materials may have a Shore A greater than about 85 and the flexible member material may have a Shore A of about 70.

10 The present invention provides for rearward and forward soles to have isolated second layers that extend beyond the conventional sole contour for increased traction and area of contact with the turf, therefore greater stability and balance to the user.

BRIEF DESCRIPTION OF THE DRAWINGS

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To facilitate the understanding of the characteristics of the invention, the following drawings have been provided wherein:

Fig. 1 is a top, perspective view of a golf shoe of the present invention with a portion broken away to expose a mid-sole;

20 Fig. 2 is a bottom perspective view of an outsole of the present invention golf shoe;

Fig. 3 is a bottom plan view of the outsole;

Fig. 4 is a bottom plan view of the outsole depicting the various axis of rotation;

25 Fig. 5 is a bottom plan view of a rearward portion: and

Fig. 6 is a side elevational view of the outsole depicting the spacing of stabilizer rods from a shank section.

Fig. 7 is a bottom view of the interconnection between the forward and rearward portions.

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DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

35 An embodiment of a golf shoe **10** constructed according to the present invention is shown in Fig. 1. The shoe **10** includes an upper **12**, a mid-sole **14** joined to the upper **12**, and an outsole **16** joined to the mid-sole **14**. The upper **12** has a generally conventional shape and is formed from a suitable upper material, such as leather or the like. An opening **18** is formed by the top portion of the

upper **12** for receiving a user's foot. Upper **12** is preferably secured to mid-sole
5 **14** with cement or other adhesives using an insole board and conventional
techniques, as known by those of ordinary skill in the art.

The mid-sole **14** provides cushioning to the wearer, and is formed of a
material such as an ethylene vinyl acetate copolymer (EVA). Preferably, the mid-
sole **14** is formed on and about the outsole **16**. Alternatively, the mid-sole can be
10 formed separately from the outsole and joined thereto such as by adhesive.
Once the mid-sole and outsole are joined, the outsole **16** forms a substantial
portion of the bottom of shoe **10**.

Referring to Figs. 2 to 4, the outsole **16** includes a forward portion **20**
coupled to a separate rearward or shank-heel portion **22**. The forward and
15 rearward portions **20** and **22** are discrete pieces connected to permit relative
movement there between. The outsole **16** has a top surface **24** and a bottom
surface **26**, with the mid-sole **14** joined to top surface **24**. The bottom surface **26** is
configured to contact the turf or ground during use. One preferred mechanism
used to couple forward portion **20** to rearward portion **22** includes a connector **30**
20 and a torsion member **38**. Connector **30** is positioned at the rearward edge of
forward portion **20**, and is received in a recess **28** formed in forward portion **20**.
Preferably, connector **30** has an interior chamber **32** with an opening sized and
configured for receiving a protrusion **41** which is at the distal end of a projecting
member **39** that extends outwardly from a torsion member **38**.

25 Torsion member **38** interconnects the forward edge of the rearward portion
22 and the rear edge of the forward portion **20** and includes: a V-shaped support
section **33** juxtaposed against the rearward portion **22** and having openings
defined therein for passage of a pair of stabilizer rods **35a** and **35b**, wherein
proximal ends of the rods are slidably coupled into channels **67a** and **67b** defined
30 in the rearward portion **22**; the reciprocating action of the rods **35a** and **35b** is
generally between about 0.001 inch to about 1.0 inch, and preferably about 0.24 to
0.28 inch; the stabilizer rods **35a** and **35b** act as shock absorption devices, and
each rod has a distal end extending away from the support section **33** and
configured so as to be received in generally cylindrical slots **65a** and **65b** defined in
35 an anchor housing **37**; and, a projecting member **39** extending from the forward
edge of the anchor housing **37** includes an elongated protrusion **41** that is rotatably
and resiliently received within the chamber **32** of the connector **30**. The stabilizer
rods **35a** and **35b** are made from such light weight materials as graphite or

aluminum, and preferably they are manufactured from titanium. The rods **35a** and **35b** are designed such that they are at a distance **D** from the outsole **16** (see Fig. 6) and while contact with the ground is possible, the amount that each rod may flex is limited by the bottom surface of the outsole. Each rod **35a** and **35b** is about 57-60 mm in length and about 5.5-6.0 mm in diameter, and each rod is about 1 to 15 degrees from a longitudinal axis **L** (Fig. 4), and preferably about 3 to 10 degrees, as discussed further below. As stated above and shown in Fig. 7, the proximal ends of rods **35a** and **35b** may slide within channels **67a** and **67b** of the rearward portion **22** within the range of about 0.001 to about 1.0 inch, and preferably about 0.24 inch to 0.28 inch.

In a preferred embodiment, connector **30** has an internal chamber **32** for receiving the protrusion **41** to form a rotating socket joint with the ability to reciprocate slightly to absorb the movement of the stabilizer rods **35a** and **35b**. In this regard, the distal end of the protrusion **41** preferably has a rounded head and interior chamber **32** serves as a socket. The connector **30** is dimensioned and flexible enough to allow entry of the protrusion **41** into chamber **32**, but also will retain the protrusion **41** within the chamber **32**.

The interior chamber **32**, preferably, has an inner diameter that is slightly larger than the diameter of the protrusion **41**, such that there is sufficient clearance to allow the head of the protrusion **41** to rotate within the chamber **32**. The inner diameter of the chamber **32** is preferably no more than 0.1 mm greater than the outer diameter of the protrusion **41** to allow movement between the two pieces without excessive free play.

In a preferred embodiment, the connector **30** may be formed of flexible plastic material. A suitable material for the connector **30** is an ester-based thermoplastic polyurethane manufactured by URE-TECH CO., Ltd. located in Taiwan under the name Utechllan UTY-85A. This material is desirable because it is available as a transparent material so that the connection may, if desired, be visible from the top and bottom surfaces **24**, **26** of the outsole **16**. The connector **30** and housing **37** preferably have a hardness of about 90 Shore A.

Referring to Fig. 4, the outsole **16** further includes a longitudinal axis **L** that extends longitudinally along the center of rearward portion **22** through the ball-and-socket connection to the forward portion **20** of the outsole **16**. A transverse axis **T** extends transversely across the outsole **16** and through the ball-and-socket connection and is aligned substantially perpendicular to the longitudinal axis **L**.

The protrusion **41** of the projecting member **39** preferably extends along an axis of rotation **R** that is configured to align with an axis about which the foot naturally rotates or torques during walking and during a golf swing. Projecting member **39** and axis **R** are preferably offset at an angle β of between about 5 degrees to about 30 degrees, most preferably about 15 degrees with respect to longitudinal axis **L**. As stated above the stabilizer rods **35a** and **35b** angle from the longitudinal axis **L** at about 1 to 15 degrees, preferably about 3 to 10 degrees.

The ball-and-socket connection defines a pivot **P** that is positioned to allow natural rotation between the forefoot and rear foot during walking and during a golf swing. In a preferred embodiment, the pivot **P** is located between the mid-foot and forefoot, preferably just behind the transverse arch of a user at the intersection of the subtalar joint axis and the midtarsal. Pivot **P** is also preferably located adjacent the exterior of the outsole. The rotational socket connection allows the forward and rearward portions **20** and **22** to move independently, pivotally, and relatively with respect to each other about pivot **P**. Accordingly, torsional management of the outsole **16** is achieved by allowing the rearward portion **22** to move independently of the forward portion **20** and thereby minimizing any strain that may be caused when the rolling motion of the wearer's foot is constrained by the shoe while walking or swinging a club. Additionally, the coupled connection provided by the ball-and-socket supports the wearer's foot, further providing comfort thereto. Advantageously, a golfer can keep more shoe sole on the ground during a golf swing by not having the heel portion of the shoe torque or lift the forefoot up off the turf.

Referring to Fig. 5, the rearward portion **22** includes a shank section **78** and a heel section **80**. The shank section **78** includes a stiff member **79**, preferably embedded within shank section **78**, which is positioned to cover a substantial portion of the mid-foot. Stiff member **79** is preferably made from a kevlar or titanium material, however other stiff material can alternatively be used to have a desirably rigid shank that preferably resists bending. Stiff member **79** does not extend longitudinally into the heel section **80** but rather allows for the heel to collapse and cushion the wearer's heel during walking. During walking and swinging, the trapezoidal-like shape of the shank advantageously focuses the torsional forces exerted upon the rearward portion **22** toward the rotational socket

joint and pivot **P**. Also, because stiff member **79** is difficult to bend, both
5 transversely and rotationally, shank section **78** preferably transmits substantially all
of the torsional forces toward the ball-and-socket joint so that a maximum amount
of rotation and bending occurs at a single pivot point **P**. In alternate embodiments
shank sections can be curved, or have other shapes.

10 In one preferred embodiment, as shown on Fig. 3, the forward portion **20**
includes a toe piece **46a**, a discrete mid-foot piece **46b**, and a forefoot piece **46c**
that is discrete from the mid-foot piece **46b**. The toe piece **46a** and the mid-foot
piece **46b** are connected together by a first flexible member **50a** and the mid-foot
piece **46b** and the forefoot piece **46c** are connected together by a second flexible
15 member **50b**. The first flexible member **50a** has a length less than the length of
either of the toe piece **46a** or the mid-foot piece **46b**, while the second flexible
member **50b** has a length less than the length of either the mid-foot piece **46b** or
the forefoot piece **46c**. The rearward portion **22** in this embodiment is a single
piece. However, the present invention is not limited to this construction and
20 alternative embodiments, the forward portion **20** can also be formed by a single
piece.

It is recommended that the first flexible member **50a** is preferably located
such that it will be generally beneath the distal phalanges area, while the second
flexible member **50b** is preferably located such that it will be substantially below the
user's first metatarsal bones. The middle of the second flexible member **50b** is
25 preferably located directly under the metatarsal heads. This optimally allows for
variability of the location of the metatarsal heads by being wider than the flexion
axis of the metatarsal heads. As a result, the flexible members **50a** and **50b** form
hinges and the outsole **16** has good longitudinal flexibility for comfort.

30 The flexible members **50a** and **50b** are formed to arch upward (as seen in
Fig. 6), and are relatively wider at their lateral and medial edges. Preferably, the
arched shape is formed during molding. The widths of the lateral edges and
medial edges are approximately equal.

35 Toe piece **46a**, the mid-foot piece **46b**, the forefoot piece **46c**, and rearward
portion **22** have similar constructions and preferably include a first or base layer **52**
and a second layer formed of discrete exterior or second layer pieces, which are
herein referred to as: **54a** for toe piece **46a**; **54b** and **54c** for mid-foot piece **46b**;
54d and **54e** for forefoot piece **46c**; and **54f** and **54g** for rearward portion **22**. In an

alternate embodiment, these components may also be a single-layer construction.

5 It is to be appreciated that the second layers **46b** to **46g** are of a design wherein they each have a rounded area extending beyond the dimension of the normal contour of the outsole. This provides the user an increased area of contact with the turf, and therefore greater stability and balance.

The base layer **52** of the outsole **16** forms the inner layer of the outsole and
10 is preferably formed from material that is soft for flexibility in the longitudinal direction. Preferably, the exterior or second layer pieces **54a-g**, form the outer layer of the outsole **16** that primarily contacts the ground. Preferably, the second layer material is firm for lateral stability. The material of the first or base layer **52** may be softer than or equal to the exterior or second layer material in hardness.

15 The outsole **16** of the present invention may be formed by various conventional methods. For example, one recommended method is disclosed in U.S. Patent No. 5,979,083 to Robinson et al., which is hereby incorporated by reference in its entirety. According to this method, the first and second layers are molded together.

20 In the embodiment shown in Fig. 4, sockets **58** retain cleat receptacles **60** that releasably retain cleats **61** therein. The toe piece **46a**, mid-foot piece **46b**, forefoot piece **46c**, and rearward portion **22** preferably all include cleat receptacles **60**.

The first layer **52** further forms sets of projections **62** and **64** that extend
25 therefrom. Sets of projections **62** and **64** are commonly referred to as "spikes" or "cleats," and protrude from the bottom surface of the outsole. These projections **62**, and **64** provide traction when the outsole **16** interacts with the ground thereby provide stable support to the golfer especially when the golfer executes a golf shot.

These projections **62** and **64** are preferably non-metallic as most golf courses now
30 require spikes or cleats of golf shoes to be non-metallic.

The set of projections **62** extend from the layer **52** without contacting
another layer, while the set of projections **64** extend from the layer **52** and extend through the second layer pieces **54a-g**. In this embodiment, the projections in the set of projections **64** extend through the first layer **52** to insure good adhesion of
35 these components.

Preferably, materials for the first or base layer **52** and second layer pieces **54a-g**, have a hardness of at least about 70 Shore A. More preferably, the material hardness is at least about 80 Shore A, and most preferably of about 95

Shore A \pm 3 Shore A. Suitable materials for the first and second layers include
5 without limitation thermoplastic and thermosetting polymers such as thermoplastic
urethanes. A specific material of preference is a thermoplastic urethane, U-95A,
manufactured by URE-TECH CO., Ltd. Other applicable thermoplastic urethanes
include Desmopan[®] from Bayer and Pebax[®] from Atofina.

The flexible members **50a** and **50b** may be formed of a thermoplastic
10 urethane that is substantially softer than the first and second layer material for
additional flexibility of the forefoot portion **20**. Preferably, the flexible members **50a**
and **50b** have a hardness of less than about 85 Shore A and more preferably
about 70 Shore A. One recommended material is manufactured by URE-TECH
CO., Ltd. under the name U-70AP and has a Shore A of about 70.

15 While it is apparent that the invention herein disclosed is well calculated to
fulfill the objects above stated, it will be appreciated that modifications and
embodiments may be devised by those skilled in the art. For example, other types
of connections, such as latches or clamps may also be used in place of the ball-
and-socket connection to provide independent and relative movement of the
20 forefoot and shank-heel portions. The outsole 16, and features thereof discussed
above may be used with other types of shoes, not just golf shoes. The flexible
member can be used with shoes with other constructions and particularly golf
shoes with or without the ball-and-socket connection. In addition, the gel cushions
can be used with shoes with other constructions and particularly golf shoes with or
25 without the ball-and-socket connection. The appended claims cover all such
modifications and embodiments as fall within the true spirit and scope of the
present invention.

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